

AVIATION WEEK

A MCGRAW-HILL PUBLICATION

DEC. 3, 1951

50 CENTS



SUBMARINES BEWARE!

A fast lens catches a GRUMMAN GUARDIAN in mid-air close-up. Two versions of this carrier-based plane work together to protect ships of the U.S. Navy from submarine attack. Some GUARDIANS carry powerful detection devices. When these "hunters" locate an undersea enemy, more heavily armed, bomb-carrying GUARDIANS, like the one shown here, come in for the "kill."

GRUMMAN AIRCRAFT ENGINEERING CORPORATION, BETHPAGE

Contractors to the Armed Forces



Sundstrand Alternator Drives develop enough constant frequency AC power on each B-36 to service 1000 homes!

In each B-36 enough constant frequency alternating current is generated to serve the electrical needs of a city with a population of three to four thousand people. This remarkable feat is accomplished with Sundstrand Constant Speed Alternator Drives which efficiently transform the varying speed of the engines to constant speed for driving the alternators. Aircraft designers are now planning on greater use of constant frequency AC power, conforming to existing and new design requirements, and saving considerable weight in wiring and in accessories such as hydraulic pumps and generators. Proved reliability of these unique hydraulic drives can be attributed to Sundstrand's reliable research, expert engineering, and precise production.



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AIRCRAFT
HYDRAULICS**

SUNDSTRAND AIRCRAFT TOOL CO.
HYDRAULIC DIVISION, MOOREHEAD, IA

AIRCRAFT AND INDUSTRIAL HYDRAULIC TRANSMISSIONS, PUMPS, MOTORS, AND THREE-OR-GEAR PUMPS • AIR SAMPLERS
(LATCHES) • MIXING, SEPARATING AND SPECIAL MACHINES • SEPARATING TUBES • MAGNETIC COILS

B.F. Goodrich



How they bring this plane down to keep costs from going up

Brought to us by the color of two major airlines—Pan American World Airways Northwest Airlines British Overseas Airways Corporation and United Air Lines. The total area of the B-36 is used by these lines is well over fifty. And every one of them is equipped with B.F. Goodrich Expansion Tube brakes.

One big reason is keep landing costs down.

Maintenance costs are reduced with B.F. Goodrich brakes because many parts found on other brakes are eliminated.

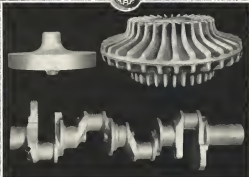
Rebasing can be handled with a screwdriver and wrench. Because the expansion tube braking action covers a full circle the load is better distributed, wear is slower and speed more evenly.

The brake block in the B.F. Goodrich Expansion Tube brakes provides greater wear even wear between the landing and the down, it prevents greater brake landing without over-heating. And because there are no rivets in any of the landing actions get full, positive braking down slow to the actual landing.

BFG brakes also give extra safety—respond suddenly, powerfully to maximum pressure. They cannot lock or grab. They take emergency overloads better.

B.F. Goodrich Expansion Tube brakes are a product of BFG research and engineering. For help in designing them into new or existing planes, write The B.F. Goodrich Company, Aeronautical Division, Akron, Ohio.

B.F. Goodrich
FIRST IN RUBBER



Wyman-Gordon—specialists in the vital forgings of the internal combustion engine since its inception—is today the largest producer of crankshafts for the automotive industry and of all types of forgings for the aircraft industry. Be it crankshafts and other vital forgings for the piston type engines or turbine wheels and impellers for turbo jets—there is no substitute for Wyman-Gordon experience.

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 HARVEY, ILLINOIS DETROIT, MICHIGAN

NEWS DIGEST

DOMESTIC

Northwest Airlines has a bid to win \$10 million and a contract for design and construction of a new airport terminal at Seattle-Tacoma International Airport. The bid is for a new terminal building, which will be a part of a larger project to expand the airport.

USAF's main engine at Camp, Ill. will be extended to about 1,000 in. under terms of an agreement with the Department of Defense, permitting the Air Force to get up more control and testing facilities in the field.

17th Wright Brothers Lecture will be delivered this year by Percy B. Walker, head of the Royal Aircraft Establishment's research section who will speak on "The Experimental Approach to Aircraft Structural Research." Lecture will be given Dec. 17 at U. S. Chamber of Commerce Building, Washington, D. C.

Glen B. Warren, general manager of General Electric Co.'s Turbine Division, has been awarded American Society of Mechanical Engineers Medal for his "leadership in the science and art of turbine design."

Personal and executive plane experts during October of last year had 6,830 in. and 1,000,000,000 in. weight, weight 21, valued at \$13,154. Previous month, 16 planes worth \$10,000 were shipped out.

Two Focke-Weller technical officers, in going to London to visit BOAC, DIT

Contract engineering. Right and main features know how.

CAL proposed fuel and rate of \$2.45 a ton for Chicago & Southwestern Air Lines, effective Oct. 1 this year, compared with current rate.

Pioneer Research Foundation has won CAL approval of its proposal to buy MidWest Airlines for \$60,000. CAL board purchase would be in the public interest.

FINANCIAL

Northwest Airlines earned \$22,107 in July-September, the first quarter of its new year, which paid out \$1.5 million for the year. Net income, for nine months is \$2,150,722—up 11% from a year ago.

Continental Air Lines reports third quarter net earnings of \$110,604, with nine months earnings of \$326,544.

Garrett Corp. has secured a \$16 million line commitment from a group of seven banks to help increase its assets and investments of its AeroResearch, Aerojet and Los Angeles and Phoenix, Ariz.

Spartan Corp. has declared a 50-cent per share stock dividend payable Dec. 1 to stockholders of record at Dec. 1.

INTERNATIONAL

Cash of a Decca Airways transport while landing at C. de la Cruz, then then August 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31.



TOP COPTER MEN MEET

Some of the men who make the helicopter a success are shown in a meeting of the Helicopter Council of the Aircraft Industries Association in Washington, D. C. Nov. 1. Left to right: Donald W. Noyes, CAL chairman; John E. Ryan, S. Lee, ATA president; Harvey Gaylock, Bell Aircraft vice president and general manager.

of its Helicopter Division, formed their own Helicopter Council, which is now the Helicopter Council of the Aircraft Industries Association, which is now the Helicopter Council of the Aircraft Industries Association, which is now the Helicopter Council of the Aircraft Industries Association.

**For the toughest jobs
pick the huskiest**



Model R-200 press equipped with a 10-ton capacity. It is a heavy-duty machine for the toughest jobs.

The husky model Trit-TRIT—R-200 and R-114—are being used in increasing quantities where great strength and reliability are required. Although these models weigh only 515 pounds they have an ultimate static load capacity of 2,400 pound inches and operate loads over 300 pound inches through 180° rotation. Zero backlash magnetic brake, adjustable thrust switches, positive overcurrent stops, adjustable position and timing, jointed bearings, and ball-bearing rollers were other features of these Trit-TRIT models. R-200 and R-114 are identical in performance but differ in mounting arrangements. The newer, lighter Trit-TRIT—R-420 and R-522—weigh 215 pounds and have an ultimate capacity of 1,800 pound inches.



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A-40



Airvac... from anywhere

Chase Aircraft's Transport demonstrated at Exercise "Southern Pine" functions which they alone are able to perform: delivery of heavy equipment into forward combat areas by loading, immediate evacuation of casualties from front lines.

Men suffering injuries at "Southern Pine" were evacuated to base hospital right from the plane zone — quickly, efficiently, safely.



Chase AIRCRAFT CO., Inc.
WING TRACON, NEW JERSEY



AVIATION CALENDAR

Dec. 4-5—Transport aircraft involved in country and system exercises, sponsored by Victory Incorporated, Hialeah Station, Florida.

Dec. 6-7—Footlock Controls System, Chel Seafield Hall, Atlantic City, N. J.

Dec. 17—Wright Brothers Lecture, sponsored by the Institute of the Aeronautical Sciences, U. S. Chamber of Commerce Auditorium, Washington, D. C.

Dec. 17—Wright Memorial Luncheon, sponsored by the Florida Air Photo Ass., Opt. Leche Airport, Florida.

Jan. 5-6, 1952—Annual Miami Air Show, sponsored by the Florida Air Photo Ass., Opt. Leche Airport, Florida.

Jan. 6-8—Annual Coast Distributors Meeting, Alfa Hotel, Wichita, Kansas.

Jan. 18-19—1951 Annual Meeting, the Institute of the Aeronautical Sciences, New York, New York.

Jan. 28-30—1951 National Meeting of the American Meteorological Society, Roosevelt Hotel, New York.

Feb. 7-8—Regional Meeting of International Society of America, Point Park Synagogue, West Shore, New York.

March 1-5—Institute of Trade Engineers, Waldorf-Astoria Hotel & Grand Central Hotel, New York.

March 17-19—Annual Midwestern Conference on Flight Mechanics, to be held at Ohio State University.

March 17-21—American Society of Tool Engineers, International Amphitheater, Chicago, Ill.

April 23-24—National Aeronautics Meeting and Aircraft Engineering Display, Society of Aeronautical Engineers, Hotel Statler, New York.

June 23-27—American Society for Testing Materials' 55th Anniversary Meeting, Statler and New Yorker Hotels, New York.

PICTURE CREDITS

1—David Whittell Lee, a United States Air Force pilot, in flight. 2—Douglas Aircraft, 18—Walt Whitman 20-21 22 23—Lester J. Whitman 24-25 26—Douglas Aircraft 27—United States Air Force 28—United States Air Force 29—United States Air Force 30—United States Air Force 31—United States Air Force 32—United States Air Force 33—United States Air Force 34—United States Air Force 35—United States Air Force 36—United States Air Force 37—United States Air Force 38—United States Air Force 39—United States Air Force 40—United States Air Force 41—United States Air Force 42—United States Air Force 43—United States Air Force 44—United States Air Force 45—United States Air Force 46—United States Air Force 47—United States Air Force 48—United States Air Force 49—United States Air Force 50—United States Air Force 51—United States Air Force 52—United States Air Force 53—United States Air Force 54—United States Air Force 55—United States Air Force 56—United States Air Force 57—United States Air Force 58—United States Air Force 59—United States Air Force 60—United States Air Force 61—United States Air Force 62—United States Air Force 63—United States Air Force 64—United States Air Force 65—United States Air Force 66—United States Air Force 67—United States Air Force 68—United States Air Force 69—United States Air Force 70—United States Air Force 71—United States Air Force 72—United States Air Force 73—United States Air Force 74—United States Air Force 75—United States Air Force 76—United States Air Force 77—United States Air Force 78—United States Air Force 79—United States Air Force 80—United States Air Force 81—United States Air Force 82—United States Air Force 83—United States Air Force 84—United States Air Force 85—United States Air Force 86—United States Air Force 87—United States Air Force 88—United States Air Force 89—United States Air Force 90—United States Air Force 91—United States Air Force 92—United States Air Force 93—United States Air Force 94—United States Air Force 95—United States Air Force 96—United States Air Force 97—United States Air Force 98—United States Air Force 99—United States Air Force 100—United States Air Force

AVIATION WEEK, December 1, 1951



FRONT PILOT LAB—Extended nose on the Road to Sight R-5 4 is for testing probe cockpit system by the Royal Aircraft Establishment, Farnborough. For safety, another pilot is seated in the second cockpit. R-5 4 is a modified two-engine trainer.



Plane News In Pictures

NEW DOUGLAS FOR NAVY—First in flight view, left, shows the Douglas R-4D (top), Navy version of the Super DC-3, and the R-4D-1, counterpart of the civil DC-6A. Leftmost, Navy has ordered substantial numbers of both types for cargo work. USAF dispositions are C-119 and C-119A respectively.

PARA RESCUE LEAVES H-19—Below, a member of the 1st Air Rescue Squadron leaves a Sikorski H-19 hovering over Japan to prove the feasibility of parachuting medical aid now from the big rotary-wing craft to aid wounded soldiers on the ground. A spread attached to the rotor path specially designed chain opens.

HEAVY FUEL BURN—Below, 5-6 lb. balloons (below) demonstrate gas lifting ability by carrying five men weighing a total of 554 lb. The 5-6 lb. is in production for the Army in the H-19. At far right is the captain's cockpit, Charles Smith.



For more than 20 years leading U.S. planes have used MACWHYTE AIRCRAFT CABLE

Building hundreds of millions
of feet of cable gives the
"know-how" needed
for better service

The skilled craftsmen who have made hundreds of millions of feet of Macwhyte "Hi-Fatigue" Aircraft Cable are experienced in every phase of its manufacture — in product engineering, metallurgy, precision fabrication.

Macwhyte "Hi-Fatigue" Aircraft Cable has maximum surface strength. And being properly PHOSPHORED, it lays down with no tendency to twist or curl. When properly cut, there is no tendency for wires or strands to snap or move out of position. It is preferred by rigging departments — the men who must handle and make cable assemblies and install them. It is used by leading aircraft manufacturers and airlines.

Controls made with Macwhyte reliable "Hi-Fatigue" Aircraft Cable and "Self-Lock" winged terminals are noted for their superior quality to resist wear, and bending fatigue. Maximum efficiency, long life, and greatly reduced maintenance save time and money.

Catalog and literature are available on request.



Macwhyte "Hi-Fatigue" Aircraft Cable is supplied in reel lots, spooled lengths, and cable assemblies. Macwhyte "Self-Lock" and "Self-Tight" terminals are supplied loose or attached to cable.

MACWHYTE COMPANY

2002 Fourteenth Avenue, Kenosha, Wisconsin. Manufacturers of "Hi-Fatigue" Aircraft Cable—"Self-Lock" Cable Terminals—Cable Assemblies—"Hi-Angle-Branded Wire Rope Straps"—Bright, Galvanized, Stainless Steel and Metal Wire Rope.



Member A D M A. and A. S. A.

"Hi-Fatigue" is a registered trademark.

199-A

WHO'S WHERE

In the Front Office

Thomas G. Loughlin, Jr., has been named a new president of Consolidated Value Aircraft Corp. Previously president of the company, Loughlin was a fighter pilot in World War II, and at one time was special assistant to the chairman of the National Security Resources Board.

F. B. Newell has been made president and a director of the Lantz-Nolle Co., Cleveland, engine and automotive diagnostic equipment firm. Newell previously was vice president-elect. Paul Miller, vice president-assembly, has been named up to succeed in retirement and Albert D. Gilchrist was advanced from chief engineer to assistant vice president-engineering.

Jim A. Gisp, general superintendent, is promoting for Canadian Pacific Air Lines has been designated assistant to the president of the latter. He joined CPAL in 1945.

Changes

J. E. Arnold has been made design manager at General's Designfield, Inc., Defense Aeronautics Laboratory, which has been set up in a separate and equal division of the company.

John V. Bouda has been appointed chief production engineer for Kester Finer Corp. H. M. Shumway, senior vice president, is assistant sales manager of all aircraft shops at Willow Run.

William L. Pallen has been designated general manager of Illinois, Inc., subsidiary of Airtemp Corp., Jackson, Mich.

Charles B. Bouda has been promoted to manager of Aircraft, Mich. Co. Division office, succeeding Henry H. Wisthal who has been transferred to plant of Allentown, Mich. Co. of Ann Arbor, Mich., as sales and service representative. Robert D. Sloan has been named head of the Allentown's gas turbine and starter sales group, and is succeeding Robert J. Wright, who has been transferred to the company's Washington, D. C., office. Robert E. Palmer has been given additional duties in connection with the handling press contacts at the firm's Los Angeles branch plant.

K. A. Williams has been made production manager at Lockheed's Marietta Co. plant, succeeding S. H. Nollan, who has been transferred to Bellco.

L. H. Bender has been named superintendent of manufacturing control and cost administration for Lincrome-Airplane Corp., Dallas.

Charles Jones has been appointed Chicago branch manager for Air Associates. Howard J. Gaudin has been named Washington, D. C., representative for Wright International division of Cessna Wright Corp.

Thomas F. McGon, Jr., formerly with the Miami division of General Motors, has been named general manager of A. V. Roe Canada's Gas Turbine division. William B. Baker has been appointed director of industrial relations for the latter firm.

INDUSTRY OBSERVER

►Boeing Aircraft Co. is considering a proposed overhaul line for Wright R-3500 engines for the R-3500 Boeing R-3500 Washington bomber. It is also considering facilities for overhaul of additional engines such as superchargers and exhaustors. A section of seven Boeing technicians has been sent to the U. S. to study overhaul line setup at the USAF Overhaul Depot, Valley Forge, Philadelphia City, in preparation for the proposed operation in Britain.

►Pasek Helicopter Corp. still has an eye up its sleeve in the form of an H-33 new two-engine helicopter design, designated model PD-25, originally one of the alternatives for the single engine over-engineered version of the H-33. It GAA needs on two-engine copiers for better commercial passenger work, the PD-25 with two Wright R-1500 engines could carry 4,500 lb. useful load. This figure is for a more engine and reasonably somewhat less with transport seats and passenger equipment.

►USAF has changed priority on the large Boeing NB-55 bomber, and no public demonstration is planned where the eight jet bomber is rolled out of the factory. Substantial ground tests of equipment will take considerable time, Seattle sources say.

►By closing 13 pre-detachment points, SAC's North American RB-49C jet photo recon planes can bring back photographs covering the entire continental U. S. area.

►British Overseas Airways Corp. is establishing eight of its Lockheed Constellation to carry 60 passengers each, in anticipation of its three-Atlantic coast run next spring. This is right more passengers than TWA is planning to carry on its Constellation overseas, although TWA's transatlantic coast Constellation carry 31. The TWA overseas coaches will carry mixed cabin and a business kitchen. Meanwhile, Pan American plans to seat 52 passengers in its DC-58 trans-Atlantic coach.

►Ford's Aircraft Engine division in Chicago has started assembly of its first R-450-51 Pratt & Whitney Wasp Major engine on schedule, but it could not be put together by Pratt & Whitney for testing. Delay is due to late delivery of nacelle tool.

►British Pines. General service turboprop plane, powered by double Mamba turboprop engines, is slated to be purchased by the Australian navy for its anti-submarine patrol work. The plane features a retractable "skid-bar" landing roller developed by equipment.

►Roll-Roller has developed a shingle mechanism for its H-33D helicopter and rotor blades. It is wrapped around blade roots in a protective against cracking of plywood.

►Ten new jet engine test stands being built by Allison Division, Gen. and Motors, near its large Plant 5 will include test beds 64 ft long by 18 ft diameter, completely enclosing the engine and fuel supply, but opened from a central access outside. The new stands will include the most advanced type of protective spray fire and explosion aimed at preventing occurrence of test stand explosion at Allison, which last spring cost several technicians' lives.

►Gordyne Co. of America has a contract with the Navy to develop its model GCA-2, a five-place coastal patrol helicopter of 3,000 lb. gross weight powered by a 490-hp. Pratt & Whitney Wasp Jr. engine. The craft, developed with government contract, has now down in more than 400 flights and is being modified for installation of internal fitness, plus added designed vertical and horizontal lift services for stability.

►New pilots have joined another squadron of North American A-1J's across the Atlantic to join combat duties in the Mediterranean. The composite powered center based after hostilities are rolling out in increasing numbers after completing modifications resulting from their first combat experience.

Slow-Motion Build-Up

Build-up of air power to 543 USAF wings and 35 Naval air carrier groups, approved by Joint Chiefs of Staff, is backing a measure with the Secretary of Defense Robert Lovett's office. Present Administration approval program will call for a 35-wing USAF and 14-carrier-group Navy.

One of the lags: The air build-up will cost too much to fit the \$50-billion-or less ceiling the Administration has clamped on the 1953 fiscal year defense budget.

Available accounts, Administration will go along with the build-up, but at a measured pace. "The total cost will be too big. It will not be spread out over many years. And, instead of achieving the air power JCS thinks needs any year JCS thinks necessary—by mid 1954 at the latest—the build-up won't be accomplished until 1955 or later.

Canada's Drive for U. S. Orders

Canada's going all out to net its firms, as on a bigger check of U. S. aircraft contracts and subcontracts.

Since Korea started a military buildup program, Canada's defense industry has been showing constant ups in place industry. But now the end is in sight.

This is the situation.

- Canada's three-year, \$5-billion defense program puts emphasis on air power, making its arms airborne and increasing the role of air in the Royal Canadian Air Force.

Out of the \$15 billion the program earmarks for hardware, about \$1.2 billion is for aircraft and parts.

Orders have been let for only \$400 million. But the remaining \$500 million, for the most part, already has been awarded for commitment.

Even a small out of the U. S. aircraft program—on contracts or subcontracts—would bolster Canada's capacity to fill small plane orders. U. S. armed services were awarded \$11 billion for aircraft purchases last year, probably will have another allocation of at least \$10 million by next mid year.

Also, as in the U. S., Canada is building up an industry base with productive capacity far greater than needed to meet its present requirements.

To illustrate how a small slice of the U. S. aircraft program would mean so much to Canada: Compared to Canada's \$15-billion three-year aircraft program, U. S. military plane purchases probably will total \$10 billion a year for several years to come.

Canada has just established a Washington organization to promote more Canadian participation in the U. S. defense program, both in direct orders from Department of Defense and subcontracts from plane manufacturers.

S. D. Pearce, a Washington director at Canadian Defense Ministry, is head man.

Ray Ross, vice president of Canadian Commercial Corp., government agency handling foreign buying and selling, is second man.

Canada has ordered \$221 million in aircraft from the U. S. over the past 15 months, but U. S. let only \$14 million in orders to Canadian firms.

But in announcing Canada's determination for a shift in this balance, deputy Defense Minister M. W. MacKenzie cautioned:

"We must realize that orders will be placed in Canada

only when there is a demand and logical reason for doing so, when delivery dates cannot be met by U. S. firms, when facilities exist in Canada that would otherwise have to be created in the U. S., when it is strategically desirable to set up a second source of supply in Canada, when a Canadian product is more suitable, and, of course, if the Canadian price is more favorable."

Research & Development Expansion

Big expansion of testing facilities for radars, guided missiles and bombs, high-speed, long-range aircraft and other jet-powered weapons. Construction of construction hangers on the small design factors: grinding techniques and engineers, steel and other sheet materials.

But that is what the services are now, moving forward with:

AIRCRAFT TESTING

• USAF—A \$120-million expansion of Edwards Base for flight testing of prototypes. This more than doubles its present \$70-million investment.

• Navy—A \$40-million development at the Patuxent Center. For its longer range planes, Navy will construct a 150-ft. tower to test radar wave patterns for long distance communication. And for its higher flying planes, Navy will build an electronics altitude chamber for tests ranging from sea level to 55,000 ft.

GUIDED MISSILES

• USAF—A \$100-million expansion of Holloman AFB for short range guided missile testing, almost doubling its present \$50-million investment.

• Navy—A \$50-million expansion at Point Mugu Test Center. Development of test facilities is just now getting into full swing.

• Army—A \$70-million expansion at White Sands proving ground, a \$15-million development of facilities at the Cal Tech jet propulsion laboratory.

• Atomic-Warfare Testing—USAF will double its \$5 million investment in Kirtland Base, close to the Los Alamos Atomic Energy project, for testing USAF applications of atomic weapons. Expansion will enable the base to accommodate B-36s, B-7s, and all jet aircraft.

• Air Defense—USAF will establish a \$12-million laboratory at Lexington, Mass., for basic research on electronics, radio physics, and other research vital to air defense.

• Rockets—Navy will make its first investment in facilities, \$7.6 million, at the Lake Denmark rocket station, where the propulsion was concentrated in a rocket facility in 1945.

What to Watch For

• Tactical air battle: Watch for Army, Navy and Marine Corps to take their cue against the USAF concept of tactical air control to Congress in January.

Parting words of outgoing Marine Corps Commandant Gen. Glenn Geary, were to denounce the USAF system now in operation in Korea.

His Assistant Air Secretary Hylford Street contended: "The Marine system might 'cause the necessary loss of American lives'."

The issue boils down to whether installations (owned by USAF) or close support (owned by Army and Marines) is to get priority.

—Katherine Johnson

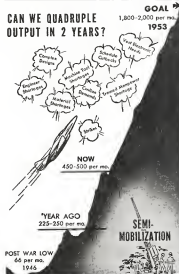
Materials Lead Time Gets Longer

	Pre-Korea	Now		Pre-Korea	Now		Pre-Korea	Now
Special bearings	6 mos.	11 mos.	Alum. forgings	4 mos.	11 mos.	Aluminum wire	3 mos.	6 mos.
Alum. bar, rod	3	6	Aluminum sheet	4	5	Stainless sheet	3	5

Source: Aircraft Industries Assn.

New Attack Opens on Production Logjams

CAN WE QUADRUPLE OUTPUT IN 2 YEARS?



• APB launches program to speed tools to jet firms.

• But no real cure-all for shortages is in sight.

By Alexander McFarley

Direct action to crack the aircraft engine machine tool bottleneck for the five principal jet engine makers—Pratt & Whitney, Allison, General Electric, Curtiss Wright and Westinghouse—now taken under Aircraft Production Board leadership in Washington last week.

Operation was in two steps.

• Manufacturers needs were checked against a national machine tool pool of all three military services. Are we chances found in the pool that were held by the manufacturers were as needed to their use.

• Other machines that the manufacturers require to get their engine production rolling were noted up as the priority lists in the machine tool rationing.

It was a "surgical" spot, just before the still higher priorities of Atomic Energy Commission and the machine tool manufacturers themselves.

Not a Case-All-Tooling requirement for two high-priority piston engine programs, for Pratt & Whitney division at Chicago (outgoing Pratt & Whitney engines) and for Chevrolet division at Tempe, Ariz. (incoming Wright R-3350 engines), will be sent on the urgent list after the five jet engine manufacturers, it was understood.

But for the two intermediate tool pool and the new urgency orders will be far from a curative of the machine tool shortage, even for those on the urgent list.

If a manufacturer needs five tools to get production rolling in a certain component, he will perhaps get one as an urgent item so he can get more production with that and will get his other four later on.

Individual assignments of value of

the jet engine companies ranged from around 400 tools upward, with only a relatively small portion of the total requirement available out of the aircraft inventory pool.

But it will mean some additional work for the engine makers, and enable some additional production.

The tool bottleneck agency program was strong, however, in only a partial answer to the long tale of criticism of the Defense Department and the no balance against the delays and lags in getting defense production rolling.

Congressional View

Most stinging official critique was released by Sen. Lyndon B. Johnson, chairman of the Senate Armed Services Committee.

Shortly asserting that the urgent program for machine tools "would not solve the problem," Senator Johnson lambasted both the Defense Department and the civilian agencies for their "overly optimistic" statement on the machine tool problem.

■ **More Production—Johnson** said further, the number of our military procurement officials [in this case] application of a selective agency system [of production requiring machine tools] could not solve the problem, "thus indicating further enough nothing ahead for the system."

"They contend," the Johnson report continues, "that such a system would only alleviate particular shortages and might result in a drastically modified machine program without practice in some along other means to keep it on schedule."

"We feel that our greatest need is the effectiveness at once of a one of tool production without to accomplish the entire military program designed to provide the maximum necessary force for the security of the U.S."

The Johnson report said it is "the question of many in the Defense Department that the machine tools should be made available to military producers without any regard to the extent to which it must be the civilian economy will result."

"It can well be that the production of some of our defense tools will have to be drastically curtailed in order to make available during tools and facilities for defense production."

■ **Reason for Delay—Washington** analysts use as this statement a crystallization of growing criticism against the "batter and gear" political philosophy which has been the real black spot in our text defense production schedules for aircraft and other defense materials in world.

The Johnson report less serious reasons given by the Air Force for delays

- **Shortage of skilled personnel** are needed for high quality steel.
- **Shortage of structural steel** for new construction.
- **Shortage of basic structural processing capacity.**
- **Shortage of machine facilities** due to maintenance of civilian production at a very high level in the automotive industry and the loss necessary for construction of new facilities.
- **The machine tool bottleneck.**
- **Manpower shortages** and stoppages.
- **Critical components shortages.**
- **Delivery Drop**—"It may well be that the defense should have been needed sooner and remedial action taken earlier," said Johnson. "While these impediments will eventually be whopped, we intend to see to it, if at all possible, that the time is taken and that the obstacles do not recur."

"Further, we intend to investigate why certain of these items were not received more quickly by us or another of the top military use civilian industries get trouble shorter and the difference diminished."

Johnson stated that Deliveries of machine tools from July 1955 through June of 1957 fell about 15% below even the adjusted conservative total anticipated for that period.

And he pointed out that the aircraft schedule is a misleading yardstick of rapidly multiplying because of the possible of neglecting them, when "for one reason or another, just before or just after, schedules in a year period have not been met."

Based on statistics before July 1955 deliveries of modernized aircraft and equipment for our 55 wing Air Force will not be made for a considerable period. Our present air strength is below what the American public expects and believes. The real test is that we do not have a modernized air fleet which begins to approach our target of 55 wings," he added.

"The Federal Government," called for establishment of a "procurement core" to ensure and expedite procurement for all three military services and to make conflicts between them.

He should be rather an understatement of Defense, with complete procurement responsibility for all three military departments, is a chairman of the Vietnam Board with broader deployment of power to "control through the aid package which seriously jeopardizes a conference."

■ **More Real Time—Some** Washington observers say that the present Manpower Board setup, with its annual inter-service committee of conference officers, each responsible to his own service, is itself slowing the defense effort which it is supposed to speed.

They question whether the setup proposed by Senator Johnson would not merely superimpose another batch of machine tools to the already available emergency already existing.

Administration View

Mano's Air Force Production Board Chairman Harold R. Byer last week described the recent scaling down of aircraft production schedules in fit aircraft engine deliveries as an expedient which "makes the lowest common denominator the limiting factor, contrary to the philosophy of production which has enabled us to train in other areas."

■ **Long Lag Felt**—"What a peaking aircraft production now is a result of what we didn't do 16 months ago," Byer said. "The lack of sufficient engine capacity to enable directly to the shortage of machine tools now that acceleration of engine production becomes vital."

It was not until some weeks that priority assistance, having related government pool orders and a sympathetic understanding of the problem, cleared the way for the machine tool industry to get its production into high gear. The lag lag is now being felt severely and will inevitably result for many months to come," he warned.

Byer stated that there is no shortcut to the proposed buildup of aircraft production to approximately 2,000 planes a month by 1957. The next new engines are not to be a continuing critical period.

"We cannot favor adjust schedules to give the lowest factor of supply," Byer said. "Rather we must balance production all along the line and do a detailed job of allocating resources in short supply to the most urgent programs."

■ **Capitals Feared**—Byer's remarks, the first frank official statement from a military production agency discussing the conflicts on aircrafts were another for the Air Force leadership. Army publication (Pence) Farnsworth at the available conflicts, and additional details about those have been reported previously in *American Weekly* (Oct. 15, Oct. 22, Oct. 29 issue).

Navalistic Adm. DeWitt C. Ransom (Ret.), president of AIA, warned that aircraft production shortages, particularly shortages of skilled employees and technicians, is becoming more and more of a critical problem in production matters.

Removes called for immediate action to be taken now, although the next batch will not be felt for a year or two. "If the situation is not faced now, that could easily become the major obstacle to high production of military aircraft," he declared.



F-89D Scorpion Carries Wingtip Stings

Recent statement issued in wingtip external structural components is the striking feature of Northrop's latest version of the Scorpion, the F-89D. Coupled with the extensive patch of the cockpit is the same basic which was used then automatically.

The first model of the new Scorpion has been completed at the Hawthorne, Calif., plant of Northrop Aircraft Inc., and is undergoing flight tests. Air Force has awarded Northrop a quantity production order.

■ **Other Changes**—In addition to the new location of the cockpit battery (in the center Scorpions they were under the wing on external racks) there have been some other changes made to the new contour of the D, even allowing for its jet engine parts and various losses, a different from the earlier wing. New nose is more rounded and appears longer.

Horizontal tail of the F-89D no longer has the external large balance struts which were found necessary after flights of the first two planes.

And Northrop has gained an 11% weight increase over the C series in its response to even fuel economy.

■ **Best at Balance**—Basically the D is still a Scorpion. The engines are Allison J35 turbojets with afterburners (gross weight is a maximum of 40,000 lb. 10 in. span in 50 ft. 2 in., overall length is 51 ft. 4 in., and height is 17 ft. 7 in.

Air Force says that the plane is in the 600 mph category and will operate above the 40,000 ft. level. Double use, dropped in Northrop, provide the speed needed according to the official interpretation version of the cost.

Further details of the Scorpion was published in *American Weekly* Aug. 23, 1955, p. 11.



New Facts on Jet Combat Worry Allies

The new kind of air war in Korea, and the increasing threat posed by the buildup of Communist jet fighters through in Moscow, created stress and consternation in the headquarters of United Nations air forces. Last week, AVIATION WEEK received parallel reports of reaction to Korean jet combat from the three main bases of democratic air strength.

From Tokyo . . .

By Alphonse W. Jozup

(Chatt. Tokyo Bureau, McGraw-Hill World News)

The Lockheed F-80 still is considered to be the best ground-attack jet in Korea.

There is considerable belief here that development of an airplane along that design line of the F-80 is the answer to the airplane-dilemma would require more. Experts here would give it a little more power and a little more speed, combine with a conventional type engine, which is less valuable than the jet.

► **Reversion**—Compared with the F-80, the modified version would have more thrust for 1,000 lb. bombs, would be capable to land on asphalt run.

While it is difficult to give exact figures here, the F-80 appears to have aerodynamic characteristics superior to the F-86 which improve its inherent speed and distance and make it better for the long trip. The F-86 has been fitted to carry such varying armament loads as two 300 lb. bombs plus four 250 lb. fragmentation bombs, two 5,000 lb. bombs plus eight rockets, or four napalm bombs.

Airframe painting problem Gen. Hoyt S. Vandenberg, USAF Chief of Staff based on his recent visit to the front in the need for long-distance jet loads on (Aviation Week News, p. 16). The Air Force has complete command over the battle area and as far north as Suwon. But there are potential areas between Suwon and the Yalu River which would give Reds bases which would extend their jet range over the battle line. The U. N. Air Force in interdiction program would be extended with.

► **Major Problem**—An overall attack by Red jets on our command fields in a couple of points at any one time would take a heavy toll of aircraft. Even more serious would be a bomber strike, possibly one or two times while U. N. aircraft were airborne. Properly armed, it would strike a lot of aircraft in the air with no place to go.

This points up a major long-term problem: adequate airfield construction equipment. It is a need.

"So far," said an AF officer, "it is (Continued on page 17, top)

From London . . .

By Nat McKinnick

(McGraw-Hill World News)

Confession by Under Secretary for Air Nigel Balch, this week, of the long-held fact that the highly touted Soviet MIG-15s are powered by copies of Rolls-Royce Nene engines he set off a wave of concern in British air circles. How have the Russians obtained such high performance from a conventional jet engine?

► **From Concern**—The *Messenger* (London) an correspondent asked: "How have the Russians contrived to build an aircraft which can fly at the speed of sound while using a conventional jet engine? Photographs of the MIG still do not reveal any weaknesses here, but it appears to be a much simpler machine than the American Sabre and, therefore, is probably lighter in weight and smaller in size."

The correspondent continues: "Technical experts will not be satisfied by General Vandenberg's statement that this is a massive aircraft unless there is a much faster explanation about it. But if the General's statement is right, it is doubtful that Britain's top fighters, the Hawker P.108 and the de Havilland Vampire 508, which are still two years from service, will have more than a margin of 50 mph over existing MIGs."

Only two British types both used and only one new in service, are now New's Supermarine Attacker, the first squadron of which went into service on HMS Eagle this fall and the Hawker Sea Hawk, which is to go into service next year.

The Russians bought 25 Nene II (4,500 hp thrust) 150 hp. Desert V engines during 1947. Both engines at the time were on display at the weekly fair.

There is speculation also about what the Russians have been doing with the Chevrolet V-12 engine, which the Gloster Meteor IV

From Washington . . .

By Don S. Lee

Secret air power superiority in terms of planes and personnel in the Korean war is a common and a serious challenge to U. N. air forces. Air Force Chief of Staff Hoyt S. Vandenberg told his first Washington press conference after his return from the Far East.

"Coming of the war in northwest Korea, although by no means lost, is not as dire as it was," he said.

Gen. Vandenberg and there was at least 1,400 Soviet aircraft in operation in Chinese Communist forces and that north half that number were MIG-15 fighters. "These fighters," he said, "are now appearing in greater numbers and with more aggressiveness below the front."

► **HR Airfield**—The Yalu River forms a boundary between Korea and Manchuria. The river after over which many air battles are being fought has been maintained by United Nations planes.

"That Chinese Communist forces are planning still heavier emphasis on air combat," Vandenberg said, because of their continued attempts to complete their major attack in the North against northwestern Korea—south of the Yalu. All three air bases are capable of jet fighter operations, he continued, but so far B-29 bombing efforts have kept them incapable. Two bases have as many as 100 or less than 20 miles.

Indication of stepped-up Communist air operations in the Korean theater, Vandenberg explained, is the fact that during the summer months MIGs sighted by U. N. pilots averaged from 100 to 400 a month. In September, he said, sightings jumped to 1,400 and in October to 3,000. This accounts an 800% increase of Red fighter activity over the summer average.

► **Superior Plane**—While still not only for immediate November statistics, he added, MIG operations this month were "about the same as last month." The MIG's superiority," Vandenberg said, "upon the design and production of which the Russians have concentrated ever since World War II is superior to our planes in every respect it can be put to use. The North American F-86—the only airplane in produc-

From Tokyo . . .

(Continued from page 16)

not in error to say that we haven't built an aircraft in Korea." Three major fields are expanded Japanese-built strips. Others have been carved out, but are far from satisfactory.

► **Tactical Superiority**—Vandenberg and Air Force commanders here said the AF has been the shipping base in Korea for fighters of the Communist Force engaged in the Far East to maintain adequate air support near to the Korean airfield.

When planes start into Korea, they land previously no military and only four battleships larger than the MIGs in the Korean air force. The AF has been in an airplane, an expensive replacement by any method of calculation but the necessary replacement which saved the American and U. N. forces.

Fifth Air Force, the tactical command of FRAP, did a tremendous job of support. In a summary of early November, 1950, the General Force command, General MacArthur's Far East command stated that the air had knocked out 75% of the North Korean tanks and 80% of the enemy aircraft destroyed during the campaign.

► **Altered Control**—Further indicated that without the air support, the Army could not have stayed in Korea. Former interrogations led to an estimate that enemy demoralization during the break-out from the Nakdong River perimeter in mid-1950 attributable to the air operations.

Most General Force commanders about this. A few, like Lt. Gen. Ed. said M. Almond, General MacArthur's

chief of staff and commander of the United States Air Force in the Far East (The Times, Tokyo) said the separate command which operated in northeast Korea during the summer of the Chinese intervention a year ago. General Almond's position is significant. However, he has been criticized by many.

He refused to refer the basic War Department command on air-ground coordination and support, even when previously asked to do so by Air Force general.

Almond also refused to meet the media applied by Fifth Air Force to maintain contact with the Joint Operations Center, the hub from which all air operations began in 1950. He has put his own communications personnel on their side, although air-ground coordination exists in the General Force responsibility for maintaining communication to the supporting Air Force headquarters.

► **From Support**—So confirmed was the military situation at this time with the separate commands of Eighth Army in the front lines and Third Corps in the rear, that Lt. Gen. E. T. Partridge, Fifth Air Force commander, had to determine the division of his air effort every morning. There was no single command to set up priorities for him.

MacArthur was too far away in Tokyo to give an adequate assessment of the situation in time to determine the requirements at every point and direct Partridge how to proceed. Partridge's staff has a supporting main commander had to lose this lead and security.

In spite of the confusion and in-

decision, Fifth gave support to Almond's Corps in such a manner that MacArthur's Fifth Air Force, commanding general of the Seventh division under Almond, wrote to Partridge thanking Fifth for the "good support" he had given to the front.

► **Van Fleet Hopes**—What Vandenberg saw from this that the overpopulation and misleading propaganda on close support will lead to a waste of American money on "airborne" "short-range" military which should be spent for more mobility for other air requirements.

He recently came away from Korea scored by General Van Fleet, commander of the Eighth Army, that the present overpopulation is a considerable waste in maintaining U. N. momentum along the front line. Van Fleet wants the air kept on the job it is doing. Today the General Force has adequate military, not quite but should like to look that air battle could carry battle through another.

With this sort of teamwork, the General Force may eliminate doctrinal errors and inefficiencies on the front line, calling spurs on no support for those targets which ground support cannot hit properly.

► **Basic Role Unchanged**—Air power is concentrated on the line of enemy supplies behind the battle line, beyond range of ground support. It shifts to frontier targets only when ground weapons can't do the job.

And Vandenberg came away from Korea with the belief that strategic bombing still retains its AF power. He made a point that only America's ability to deliver the atom bomb drives the Russians from World War III.

From Washington . . .

Now today capable of challenging the MIG on approximately even terms.

The MIG is a light and fast airplane of somewhat shoddy design, he added, and has outstripped the best airplanes that have been tested against it.

"What is disappointing about the performance of the MIG is its demonstrated ability to operate at speeds in excess of the speed of sound. It has performed in combat of course, both in the Korean theater and in the Middle East."

► **Pilot vs. Plane**—The high quality of the MIG design should give a warning to this nation, he added because not only have the Soviet Union shown the problems of extremely low speed aircraft, but in many cases they have solved aerodynamic problems which still hinder us.

But, he said, superior training and combat techniques of U. N. pilots give them the edge over Red China

airmen, even though our F-86 and their MIG are just about evenly matched. He said reports on our World War II B-29 and the later B-36 were being taken down in large numbers are not true. To the contrary, he pointed out, until the present time the U. N. has suffered only 11 B-29 and B-36 combat losses at 11,751 enemy.

The jet fighter now has been approximately 500 in air force. USAF has lost a total of 146 fighters during the last three months—September, October and November.

► **How Felt Alone**—"One last criticism of the war goes on and if the enemy continues to increase his air effort at the present rate we are certain to be at the end of the road," Vandenberg said, "this is clearly in a few hours and better fight it as it is."

"The Russians have quoted the official meaning of the resolution in the free press brought about by the U. N. in the Korean theater. It is obvious that they do not intend to accept the frustration of their world wide arm-

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Senate to Probe AMC Irregularities

Senate Predecessors Committee, headed by Sen. Lyndon Johnson, co-sponsored a bill to investigate "fraud and corruption in the letting of contracts" at Wright Patterson Air Force Base.

A subcommittee for this group said that it is "very likely" because would be held at Dayton before the convening of Congress in January. No date has been set.

Sparkman Pleads For Nonsked Coaches

Senate Small Business Committee Chairman John Sparkman has headed at "a paradox" the CAB threatens nonsked coach demand increased, in spite of Congress' success. Sparkman wrote CAB Chairman Donald Nyrup: "It portrays the growth of air coach with considerable eloquence and then depicts an application which would further that growth."

And he continued: "I am convinced the nonscheduled nonskeds can and should be allowed to live and grow without detriment to the country's air transportation industry—in fact, with great benefit to all segments of that industry. I ask that you let them do so and you have accomplished your long term goal."

◆ **Adams' Threat**—In the "transportation" coach-type service card, the five-man Board held 4-to-1 that there was no "public convenience and necessity" for more air coach service than the regular certificated airlines could give. CAB Member Joseph Adams threatened strong both the public and the regular airline will have given from the nonscheduled air coach service of the nonskeds a threat (Associated Press, Nov. 10, p. 8).

Sparkman mentioned Adams' dissent "It seems to me that Colonel Adams has grasped the underlying economic and social facts in this problem. In his dissent in the 'nonscheduled' case, he gives credence, in my judgment, that there are hundreds of thousands of persons who will not fly if the Board rejects a definite commitment in the air coach as it is currently provided in nonskeds is good."

◆ **Need Expansion**—Sparkman recalled an earlier letter from his committee to CAB, stating "It seems to me that the CAB might well re-examine its whole approach toward air transportation. Certainly its restricted view, resulting in the use of solely to provide high-cost luxury air service for a small part of the population needs re-examination."

"The operation of the non-scheduled air service has demonstrated that there is strong public demand for cheap air transportation on a readily expanded basis."

Nonskeds Airline President Anne Flowers' membership has given off another blast of his own against the CAB delays denying public convenience and necessity of widespread view scheduled airline coach service. "This is the board that in 1947 and 1948 forced his members upon the American public at that time independent operators were establishing their own transportation services."



HUGGINS TAKES AF POST

Edwin V. Huggins last week was elected to succeed John S. Anderson, Secretary of the Air Force. Huggins has been executive vice president of Westinghouse Electric Co. and was secretary and head of the law department at that organization before becoming vice president last May. He served five years as chairman of the National Security Industrial Association and holds Ph.D. and his degrees from Yale. The new office is a nod to Mayfield, N. J.

Truce Won't Alter U.S. Air Planning

A truce in Korea would have no effect on USAF and Navy air expansion program, American Work has learned.

Said Air Force Secretary Thomas K. Mayfield: "Our basic defense policy is directed as to whether or not we of the United States will have the wisdom to build and maintain a force of this kind—that we will be subject to fluctuations in opinion as a result of some temporary impression in the international case such as successful resolutions of the Korean war."

◆ **Letter Not Counted**—"Being strong can be expensive and dangerous," he said. "But being weak is an invitation to disaster. I believe that with the facts before us, we Americans will have what it takes to maintain the kind of establishment and its members in even at the cost of considerable economic cost and expense to ourselves."

Athletic losses of aircraft in the Korean effort under Air Force updates was said, at present are not being counted against the overall expansion program beyond the 95-year vintage presently projected.

For example, he said, one expansion is figured on a presentment and production rate—of the cost in dollars, planes, etc. of Korea. Now, if expansion programs are similar, he said.

◆ **Korea Is Warning**—Military expansion in planes, tanks, ships, and guns still surface expansion started, is geared to offset possible aggression from Russia and not related to the relatively minor losses suffered so far in Korea.

Aggression in Korea, while at high cost in men and material, much served as the catalyst which awakened the nation to its military weakness, particularly in air power.

ARB Certification Of Comet Is Near

High tests for certification of the de Havilland jet Comet by the British Air Registration Board have been completed, R. E. Hordle, chief executive of the ARB, told American Work.

A total of over 1,500 hr of flight tests, including all tropical tests, have been completed and the ARB is in a position to make technical certification immediately for the Comet for passenger operation as soon as the paper work is completed. Hordle, however, declined giving a date at the British Embassy in Washington.

Then past the British plane now, technical stop-over to operational status as the first jet passenger transport for round the world routes, making at over 450 mph.

Nevertheless, Civil Aeronautics Administration officials at Washington confirmed that they would not be able to accept the ARB certification of the Comet for use in U.S. airlines without CA's own tests or extensive check by CA's technical staff of test data supplied by British.

Overseas National Airways, which wanted to use two Comets for U.S. operations (Associated Press, Nov. 24, p. 14), would not risk paying for possible certification tests by CA's in addition to other production expenditures.

Sabena's Copters Complete First Year

High reliability of service during its first year of scheduled rotor mail flying has prompted Belgium's Sabena to go ahead with plans for increasing the copter's utilization.

Sabena's two Bell 47 DTLs flew the 26th mile, coast with an average capacity of 93.2% for the rotor and 86% separately for the rotor, carrying some 50 tons of mail, representing some 150,000 letters. Weather outages the rotor during 9% of the flights. Technical difficulties were responsible for 7% of the delays. Sabena has equipped one of the Bells for instrument flying, and says the pilots become familiar with blind flying procedures, hopes to lick the weather.



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PRODUCTION ENGINEERING



HALL OF GIANTS is Lockheed's multi-million-dollar hall to keep manufacturing fuselages in pace with drops in at least 15 years.

Lockheed's Investment in the Future:

Giant Machines for Highspeed Designs

- Trend toward higher Mach numbers calls for strong, relatively thin structures and new techniques.
- So Lockheed has been installing special "heavies," to let manufacturing keep pace with design.

By Irving Stone

Barbours-A mighty fabrication facility prepared to keep pace with surface design for a minimum of 15 years is rapidly being grabbed to completion by Lockheed Aircraft Corp.

The Lockheed "Hall of Giants," sprawling over an area of approximately 150,000 ft., houses a special battery of manufacturing "heavies," usually large, by present-day aircraft industry standards.

All of the Hall's machinery and equipment is Lockheed-owned. The same units, installed, represent an investment of more than \$24 million, with the special building adding an other \$4 million. The facility exceeds a cheap 90% occupancy and after the end of the year it will be in full swing.

► **Insight**—Lockheed's recognition of this machinery and equipment points up the foresight of its manufacturing engineers. The units were specified in 1948—at a time when the airplane sales market had a low level and the aircraft industry wasn't overclouded. Today, these tools probably could not be obtained within reasonable time limits, and certainly not at 1948 prices.

Other companies are tending toward adoption of the heavier type machinery, but so far as it is known, none has as full a complement as Lockheed.

Plan for the Hall of Giants began to roll in the winter of 1947-48. Purpose of the facility was to open up the capabilities of the manufacturing branch so that engineering design could be converted to shape. ► **New Requirements**—Lockheed's plan

was prompted by the trend in aircraft design moving generally from the comparatively high Mach numbers being attained and the still higher speeds anticipated. The strong, relatively thin structures required would not lend themselves to the built-up assembly scheme that led to bottlenecks.

Machines were needed that would produce long stretches of integrally stiffened skin, tapered configurations and "sculptured" plate stock. Then, too, it was obvious that these sheets would have to be formed to some extent, and this would require larger bed sizes and high tonnage.

In substance it amounted to this: Engineering had to have a general idea of the capabilities of production machines it could design into, and production would have to specify the details of the machines to translate the design into feasible fabrication.

► **Looking Ahead**—This meant that the machines would have to embody capabilities beyond present "advanced" airframes and offered a ability that would span at least 15 years in taking care of design progress.



SKIN MILL, by Giddings & Lewis is believed the only one of its type in making additional skins. Cutting heads spray out chips at rate of 2.5 inches a minute, to be caught up (shown) left at its left, and dumped in hopper outside the building (shown).



UNDERGROUND SUBSTATION by G&L does not contain all the electrical wiring equipment to run the machine. At right is one of the cutting heads and the operator's moving control station. A stationary control panel on the machine is used for setting up.



Accordingly, the equipment was specially selected, because no standard machine tools were considered by Lockheed to be able to do the job required.

Obviously, necessary could not be a controlling factor. But one company Lockheed manufacturing engineers are one of—with integral stiffening was thrust into the basic component, the larger the part to be fabricated, the greater will be the strength through lower tools, fewer joints, and fewer joints and pieces to boost assembly complexity and time.

This approach gets more and more fabrication in the overall plans. But heavier detailed assembly work largely is eliminated, it is expected to be

cheaper in the end. Meanwhile, no comparative figures are available since the cost comparison point has not yet been reached.

► **Cost**—Giddings & Lewis, the major machines and equipment that Lockheed has put into the Hall of Giants.

For cutting operations, highlights of the Hall at the Giddings & Lewis skin mill—believed to be the only machine of its type in industry—solidified sheet (Aircraft Week July 9, p. 48). It is a masterpiece of size and "intelligibility."

In first job will be to cut one-piece, integrally stiffened skins by the F94C and tape the sheet over the bare beam. It will also be used for the

General, on upper and lower surfaces of the inner wing panel and on the outer panels of the main body. Obviously it will be applied to new designs from here on.

Lockheed specified the skin mill and collaborated with G&L, and General Electric Co. to get a relatively high-production universal machine both in mill and profile sheet 18 ft. wide by 32 ft. long—this being considered the largest plate stock that generally will be handled by the mills in the next 15 years. Cost of the G&L machine installation is estimated at more than \$400,000.

► **Why the MGR**—The company's manufacturing engineers are engineers of

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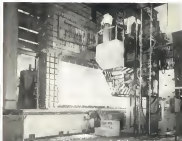
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FLIGHTROLL cuts lighter leading edge panel (lower section) from pattern at top.



KILLER DUPLICATOR makes steel and metal plate dies for forming metal's exterior.

its, perforation of hanging and unloading schemes. But the relatively stiffened panels it is felt that there are now limitations imposed by available press capacities, size of pieces and volume of production to justify the cost of the dies. Another consideration is that forging technique will have to be developed further.

The extrusion method also is limited by the size of the piece—the size of the billet that can extrude. Up to the size they can extrude, Lockheed feels extrusion is a good scheme, and already is using a number of the extrusions in secondary structures. It gets them in

storage bins. These are light and thin stretch level.

All the three processes—rolling, forging and extruding—can be in place, but Lockheed feels that where you have relatively small experimental contracts with limited number of parts, the rolling process seems most feasible. Also the G&L machine has such flexibility that large or small sheets and heavy gages can be handled, and it can serve as a "volume production" tool to mill relatively stiffened dies or tapered dies.

► One for All—The new G&L dies will combine in one tool a machining

Capital Airlines Specifies VICKERS PUMPS for its fleet of SUPER DC-3's



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all efficiency, (2) very low weight per horsepower, (3) outstanding dependability and unusually long life. Other significant considerations were the importance of standardization and low overhaul costs.

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employment that annually would at least separate machines for milling and tooling. The machine and is 18 ft long, 30 ft wide and 30 ft high, weighing 200 tons. It uses 12 drive motors totaling about 370 hp., exclusive of 18 motor and generator delivering the power supply (JIS General Electric). The table has a working area 10 ft wide by 34 ft long and will handle loads of 150 tons.

Operating in three dimensions with two lead motions, the machine is designed to work in a feed range from 1 to 120 in./min., with infinite intermediate speeds.

A two-dimensional, electronic mass control simultaneously guides the longitudinal and lateral cutting motions and a vertical rise and fall cutting, allows automatic variations in web thickness. Speed control and the steering control which guides the cutting angle are combined for ease of operation.

A control gives the operator a good view of the work and allows him to move with ease from one end of the machine to the other.

The cutting heads use the fast 100-hp. units made with angle roller and shaft end, as a result, are considered the most compact power units of their type.

► **Chip Removal**—The cutting action opens out a bladed chip, converting sheet 680 in. in./min. at 100 750° into metal flakes—the equivalent of 2-3 blades of loose chips.

From the cutters the chips are blown through a hood into an inclined rubber belt conveyor that leads another transverse conveyor leading to an inclined belt leading large elevated hoppers below the building. From there they pass the chips are dumped into trucks.

To insure that the machined part will be held flat, the mill is fitted with a large universal master vacuum plate of six sections. These comprise the surface plate mounted on the table of the machine. The plate essentially is used alone for experimental parts or limited production. In addition to vacuum-holding, mechanical hold-down is used around the periphery of the part.

► **Job for Plate**—The plate also is designed to mount an auxiliary or project plate for one particular part and is an easy and quick means of checking up for repetitive runs. And the vacuum plate can be tilted, section by section, for mounting up slabs which are to be tapered.

The tilting may be done long-handled, manually or in a compound direction, and is accomplished by methods under 18 in. a shop size plate, the tilting elements being calculated and ground slabs inserted under the top of the section.

The complex function of applying the vacuum surface such as electrical

metal that doesn't move at 10,000 RPM...



The buckets in a jet engine have a mighty urge to stretch... the combination of 1500° of heat plus the centrifugal force generated at 10,000 rpm makes almost any metal want to grow, or "creep." But the high-temperature alloys in the moving parts of jet engines just don't get along with any creep in the buckets.

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JET DIVISION

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Turbine Wheel for Jet Engines



Buckets for Turbine Wheel

vents, hydraulic and control lines, air pressure hoses, etc., would normally complicate a machine of this type beyond the point of practical workability. This is overcome by an ingeniously designed feed reel that winds, pays out and takes up to the continuous without the usual encumbering slack.

► **Control Setup**—The machine's steering control system, which can be positioned to any point along the front of the reel, holds the quadrature controls operated by the operator. Other controls, used in setting up the operation (which feed in heads will be used, up and down or horizontal movements) are at the end of the reel on a fixed station.

In addition, there is an underground control room containing all the electronic and electrical operating equipment. This really is a substation in relation to the machine. Many power cables to hoist and direct feed sets of autotransformers which supply power to the cutting head motor. Also, there is a 10-kip motor coupled to two single drive generators, one feeding the hoist, the other, the other feeding the turner motor on the reel carrying the heads. Vertical rotation of the cutting heads is controlled hydraulically, as are tilt and roll speeds.

There is another panel that sits in the cut the various machine terms—

hoist, control, mill, slitters, mill, slitters, etc. The various machines are interrelated, so that failure of a vital source will shut down the machine.

Now Lockheed engineers are waiting the huge steel mill through its entire thickening period to determine required adjustments, alignments, calibrations, and so on for required accuracy, etc. Operations are being tested and engineering test runs are being cut preliminary to production runs. The control tool on the machine also allows evaluation of electrical and hydraulic controls, and gauges showing on fabric machines of that type.

► **Other Tools**—Another cutting tool in the Hall is a Cincinnati Milling Machine Co. (Hobart), used the largest of its type. It has a vertical angle plate 17 ft high and 167 in. long.

The upper part of the machine carries the lower control and the lower portion contains the work-holding area. Cost of the machine was about \$150,000 (unfilled).

There is a large Keller duplicating machine, primarily used to make thicker die than steel or Kalsbein. It serves to duplicate grinding of the cutters for dies, by producing the contour required directly from a model. Its cost was about \$45,000 installed.

► **Forming Tools**—For forming operations in the Hall, Lockheed's engineers chose three methods—done directly and indirect. Scheduled to handle the drawing operations is the 5,000-ton Babbitts hydraulic press, a hydraulic and stretching 34 ft above the factory floor from a 12-ft deep 145-ton level has extended as a 36 x 42 ft concrete foundation (Movement White Sept. 1 p. 14). The machine represents an investment of about \$225,000 and Lockheed spent about two years talking and negotiating with manufacturers about phases of its design. A test went into construction.

The machine is the world's largest triple action hydraulic press.

The tool will enable Lockheed to do what it couldn't do before—form large sections of integrally stiffened discs as well as immensely large heavy pipe or sectional steel punch. If it had been employed in the fat tubing of the Concorde, Concorde and the PTV Neptune, the press could have formed out language parts, including in lower plates, roofs and other outer casing and weight-bearing details (Veterans Wire Oct. 22 p. 47).

Main size of the press can exert a 5,000-ton force. The drive shafts are fastened to one end to one end to 3,000 tons. These two components can be linked together. In addition, a hydro-pneumatic machine on the bed of the press has a 2,000-ton capacity.

The machine will be used for normal deep-drawing operations with the punch



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SIKIRIKORO press is set up outside building (left). It will be extended around it later.



At right, Hartford stretch-wrap press.

mounted on the run or the press bed. If the punch is on the run, 5,000 tons of force are obtained; if the punch is on the bed, up to 5,000 tons can be exerted.

All three runs can be independently operated during any portion of the cycle.

The press is only now being installed. Its huge proportions and the rigging operation involved required a minimum

of obstructions. Accordingly, the area of the Hall that will accommodate the press now has no walls or roof and enclosure will have to await final construction on the machine, which should be ready for operation in the next two months.

The Hall's stretch-up part is a 200-ton Hartford-let of this machine. It installed cost was about \$435,000. It presently is used to stretch-down

large containerized steel punch and long containerized extension. It will handle a 24 ft. 755 W. extension with a cross-sectional area of 1 sq. in.

It will accommodate going 24 ft. long and 6 ft. wide in which thickness would be a function of 1 sq. in.

For impact forming, the Hall uses a 20-ton Clamhopper Corp. drop hammer (soon will lift a 20-ton die). Lockhead engineers say that its capacity is



CLAMHOPPER drop hammer will lift 20-ton dies. At right is stretching of up, including oven and quench tank, drawline and degreaser.



double that of the previous largest stamp. With installation, its cost came to approximately \$150,000.

► **Tooling Equipment**—A huge turbo-hydroline degreaser handles parts for receiving, followed after machining or forming operations. It is a companion piece for the G&L die mill, described previously, the Hartford, Connecticut, and other units in the Hall.

An oven-and-quench tank installation

reaching from deep below floor level to almost roof height handles the heat-treat phase in conjunction with forming operations.

In this compact arrangement, the oven is located above the floor with its drawline leading down to the quench tank below the floor. Transfer of materials between the two is easily accomplished, the parts remaining in a hot tank throughout the cycle.

Another unit planned for the Hall is a large arc box for holding anodes. This will be on rollers to allow movement between heat treat oven and anodes.

Details of opening and closing the arc box door so that temperature control could be maintained was one of the major design problems. The unit will be top-loaded, with doors opening and closing hydraulically.

The degreaser, oven, quench tank



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and inches will take the ultimate test sheet the final will handle—10x14 in. Cost of this processing equipment is figured at about \$100,000.

In addition to these machines and related equipment, there are special braising ovens, highspeed burners, a 35-ton-capacity die blade and other miscellaneous standard tools.

Flow Construction-Specialties constructed floors had to be laid down to take the loads imposed in the new fabrication facility. And loading of her 16-ton overhead cranes for strong material across the area or serving equipment that is top-loaded.

These are reported to be the only cranes of this capacity in the Los Angeles area that operate on a cross-over arrangement connecting the two bays of the fabrication facility.

The improving capabilities of the Halls have sensitive equipment points up the increasing importance of the manufacturing changes in the aviation industry's future.

With design trends answering growing demands for stronger structures, less weight and greater fabrication accuracy, testing and production equipment are hard pressed. Lockheed's effort is one industry indication that manufacturing men can meet the problem ahead.

Cornell, GE Set Up Electronics Center

The provision of additional research and development facilities for military electronics is an immediate objective of a joint effort by General Electric and Cornell University. In a pioneering venture, as cooperation in educational and industrial research, GE and Cornell have established an advanced electronics center in Ithaca. The overall purpose is to carry out advanced research and development in the field of electronics and to provide research and engineers with teaching and educational opportunities.

The center, called the General Electric Advanced Electronics Center at Cornell University, will occupy a mid-sized laboratory located on Cornell property adjacent to Ithaca's East Hill Airport. The modification of the building is scheduled to be completed by February, 1952.

Manager of the center is Reg. Gen. T. C. Jura. Int'l. activities will be directed by a few men management team, two men from industry and two scientists.

Cornell will give faculty appointments to a number of staff members of the center, retain members of the faculty and staff of Cornell who are employed by GE after its construction.

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Research Limit

- Saturation reached in collegiate air studies.
- And faculty shortages rule out expansion.

By John F. Matelli*

Substantial increases in collegiate aeronautical engineering research are not possible without enlarging educational programs in the field.

This is one conclusion reached by the Engineering College Research Council after analysis of a national inventory of college and university research resources.

But the Council also says that some increases can be achieved if the holes in the research pattern are filled, and if faculty members who take an interest can get additional help.

► **Project Reports**—The pattern of aeronautical engineering research in college-based institutions is shown from the complete report of a survey completed last summer by the Council's General Board on Aerospace with Military Research Agencies.

The national inventory covered special interests and activities of faculty and graduate students in all physical and engineering sciences at 750 colleges and universities in the United States. Over 24,000 faculty members, and an equal number of graduate students, were reported.

An informal review of the list of schools from which no replies were received suggests to the committee that "substantially all" of the national potential for research in college and universities in the physical and engineering sciences is covered.

Of nearly 25,000 faculty members reported, 28,000 are considered by their institutions to be qualified to perform research, but only 12,700 are now active in research. An average of 27% of total faculty time is spent on research activities, and an a national average 45% of this time is allocated spent on defense research studies sponsored by military agencies or their industrial contractors.

"Putting these figures another way," Dean A. P. Spilhaus of the University of Minnesota and chairman of the council committee, has pointed out, "of the 25,000 faculty members reported, one-half are active in research, three spend about one-half of their time on research, and one-half of this is devoted to military

* Graduate, Engineering College, Newark, Ohio.

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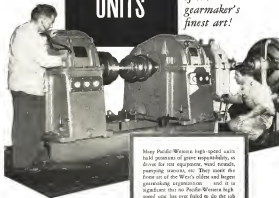
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research. This means that one eighth of the total college effort in these fields of engineering and physical sciences is already devoted to defense research!

► **New Statistics**—The Council's big new show that 52% of aeronautical engineering research in colleges and universities is now directed toward defense needs, sponsored by federal agencies or industries active in military development. No other field of the engineering or physical sciences shows such high concentration on defense activities.

In aeronautical engineering, there are 452 faculty members and full-time senior research personnel. Of these, 97 are judged qualified to participate in research projects, and 415 of them are now engaged in research. This effort is equivalent to the work of a full-time research staff of 290, of whom 217 would be engaged in defense projects for military agencies or their contractors.

In all, defense research amounts to slightly more than one-third of the total faculty effort—including teaching, administration, engineering work—in aeronautical engineering in the United States today.

In all the physical and engineering sciences, aeronautical engineering stands fourth in the total volume of military research now underway in colleges and universities. The 237 "equivalent" full-time area assignments are exceeded only in the basic sciences of physics (509 workers), chemistry (336 workers), and electronics (314 workers).

Almost 8% of college defense research today is in aeronautical engineering.

► **Non-Faculty Effort**—Graduate students and assistants in aeronautical engineering total 136, and their effort is equivalent to that of 254 full-time senior research staff members.

More than half of the total defense aeronautical research is concentrated at seven schools: University of Michigan, University of Minnesota, Princeton University, Massachusetts Institute of Technology, California Institute of Technology, Polytechnic Institute of Brooklyn and Northwestern University.

These schools reported the equivalent of 316 full-time senior research staff members.

They have 208 faculty members and senior research personnel in aeronautical engineering—more than one-third of those available throughout the nation. In the "big seven," nearly two-thirds of the total faculty effort in aeronautical engineering is devoted to defense demands, compared to slightly more than one-third in all colleges and universities.

Of the total of senior faculty and research staff members qualified in pe-

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cluding five of the "big seven" and two maintenance reporting as defense assignments. Early maintenance light systems were scheduled, three of these are shown in the "big seven," and one in the group is without any defense research.

► **Potential Gains.** One possible research gain was suggested by the rate of senior faculty to graduate students—about 1.2 to 1.

The Committee felt that new faculty members should be able to direct the work of several students, instead of the average of slightly less than one.

An increase here would add to the future manpower supply for the au-

tom industry, although it might remove some young men from the ranks of those immediately available for work.

In pointing out that research assignments can profitably be assigned to many schools not now involved, the Committee underscored the importance of secondary benefits from such assignments.

New research activities will, if properly organized, strengthen the educational programs with which they are associated, the report stated.

This, in turn, will assure an increasing supply of well-trained students to help fill the critical manpower needs now facing the aircraft industry.

Wingtip Heaters For Globemaster II

One of the latest refinements on the Douglas C-124A Globemaster II is a wingtip-mounted de-ice heater.

One of three units, based in a tip tank configuration, is supported at the end of the wing span on each wing panel.

This arrangement affords several advantages over previous installations in early versions of the C-124A, where anti-icing heaters were buried in the wings.

The two tip-type heaters are supplemented by two others located in the tailcone for tail surface anti-icing. ► **Boosts Safety.** These four heaters, each of the instant type and capacity—600,000 Btu—replace 40 units of older different sizes formerly required for the job.

In addition to a net gain of 900,000 Btu, maintenance and checking of spare parts is simplified because of heater interchangeability, Douglas engineers have pointed out.

Another feature introduced with the new arrangement boosts operational safety.

The wingtip heaters are located 34 ft from the instant fuel cell. From only, heater and wing fuel tanks were only 1 ft apart and separated by the spar web.

The added weight introduced by the heater at the wingtip is double that of a structural strengthening, Douglas says, because it reduces the bending moment at the spar. And the plane's service ceiling is increased by approximately 1,500 ft because of the favorable end plate effect of the heater pods. Another feature is the incorporation of a ground blower for removal of ground ice across the web.

► **Study Covered.** The installation of the tip-mounted heaters came after an intensive studies and physical tests, which introduced both as high as 200 ft for the heater supports.

The pods were tested in their static loads by dropping them a gaillotte type test rig while the heater units were operating.

Provisions for wiring the tip heaters for ground heating of engines also is being studied. And, on one plane the heater exhaust system is being tested for purging the wing fuel cell area with inert gas to prevent fire from heater leaks.

The wingtip heater installation was actually was conceived by Warren Bates of Douglas' Long Beach area condition group, and developed under the direction of W. F. Walker, chief of the section, and C. G. Brown, design engineer.



Hiller Copter Has 'New Look'

Korean experience results in 54 major engineering improvements in H-23B over 360 commercial version.

Hiller's newest copter, the H-23B, really has the old saying about new wine in old bottles. Basically, the H-23B is the old bottle—the look is its production, the H-23A, a busy conversion of the Hiller 360 commercial copter.

► **New Wine—Older.** New wine has been poured in, in the form of more power, improved load-carrying capacity and many design changes suggested by the military experience in Korea.

As a result, the H-23B is very nearly a new aircraft, not just a simple modification of an earlier type. And right now, the craft is coming off the production line at the Palo Alto plant of Hiller Helicopters "at a good clip."

► **General—That's** quite a story behind the H-23B. It is no fact Hiller's first aircraft designed for the military service. And it is, says Hiller, almost entirely new when compared to its predecessor, the Hiller 360 and H-23A.

In the fall of 1950, after a few copters had shown their capabilities in Korea, Hiller began conversion of the 360. About ten days after approval was given the mechanical equipment installation, the first H-23A came off the line for the Navy. Later the Army's H-23A was built on the same production line.

These service copters were civilian types with "Bee" such as rotary engine, a four stick and special aircraft equipment. And it was soon apparent under power in Korea, that civilian equipment, instruments and bearings couldn't take it.

At one time, these days' time was 37 ft, within one of the old one-half-copter—a higher ability than was ever expected in civilian service.



NEW COCKPIT for H-23B is modified, but other features to make flying easier.

And, as Hiller says, "A helicopter with automotive and Cub airplane-type parts will not stand up under that type of service, particularly with 400 extra pounds of military equipment."

The ending was inevitable. The H-23A began breaking down. Spares were not available. The craft had been converted to fuel, and moved into Korea so soon that the spare parts were supplied with a military aircraft were not on hand. The H-23A finally were pulled out of Korea and sent back to Japan.

► **Design Changes.** As a result of service experience in Korea, Hiller held an engineering conference to coordinate the changes suggested, agreed and decided by such in the field. After the conference, 54 major engineering

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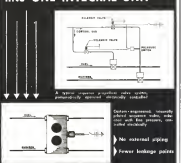
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changes were made. And the Army followed through with a large production order for the rectified copier, which was to bear the designation of H-23B.

Of course all of these changes were not made at one time.

As production would allow, changes were made into the H-23A, with the result that the last H-23A actually incorporated some of the improvements of the H-23B.

Modifications included all new transmission, fuselage sections, engine section, controls and instruments. These exist in an aspect of the A model, the H-23, but all these plus a 300-hp engine and dual gear.

► **Increases**—The H-23B now is powered by a Franklin 6V-200-C-3 engine which develops 300 hp, against the H-23A's 175-hp Franklin engine. This engine has boosted the empty weight from 1,697 lb. to 1,756 lb., but has also permitted an increase in useful load from 701 lb. to 744 lb.

Basic dimensions remain the same, with slight increases in height to top of cabin and top of rotor.

Cabin weight is raised 100 lb. to 2,400 lb. And increasing the gross weight while keeping the maximum moment has resulted in a slight increase in rotor due loading, from 2.49 psi to 2.6 psi.

Other basic dimensions include rotor dia., 75 in.; overall length, 18' 7" and overall height, 6' 7".

NACA Reports

NACA Technical Note is a reprint of papers presented at technical conferences for scientific use only. They are obtainable, free of charge, only by persons having a professional interest in them. Write to Director of Research Administration, NACA, 1204 F St., N. W., Washington 25 D. C.)

► **Theory of Flame Propagation** (TM 1295). On the Theory of Combustion of Diffuse Unsteady Gases (TM 1296) —both by Y. B. Zel'dovich.

These two brilliant monographs are translations from Russian scientific journals of about three years ago.

The former paper is one of a mathematical approach to the problem from a physical chemistry investigation. It deals with the conditions under which the common processes during combustion.

Zel'dovich develops a theory which considers the rate of reactions occurring at temperatures of 1,500 to 3,000° for time periods in the order of a millionth.

Equations are set up for heat conduction, and diffusion considering these propagated in an explosive gas line. An estimate is given for the upper



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and lower limits of static velocity.
The second mechanism assumes a steady process with continuous replacement of the metal interstices and continuous removal of the products of combustion.

For this and other limiting assumptions, it is shown that the combination of the products of combustion and the temperature of the flame surface are the same as for the combustion of a stoichiometric mixture of the gas. It should be noted that this paper deals with unsteady gases.

► **Acoustic Supersonic Flow in Rotating Turbines** (TN 2345)—by Arthur W. Goldblatt.

This paper is a contribution to compressible techniques for turboachinery. Primarily it extends two-dimensional supersonic flow to the flow in the three-dimensional action between compressor blades. Because there has been no practical method of using three-dimensional calculations in this region, the procedure has been to use two-dimensional theory, with certain limiting assumptions.

Goldblatt's method, which was devised at the NACA's Lewis laboratory, deals with symmetric sections of flow which are neglected in previous methods. He assumes a large number of blades in the impeller and considers the average circumferential flow.

This technique, combined with estimates of the blade-to-blade variation in flow, is useful for designs with closely spaced blades.

► **Possible Applications of Blade Boundary-Layer Control to Improvement of Design and Performance of Axial-Flow Turbochargers** (TN 2371)—by John T. Simcik, Jr. and George R. Conkle.

Research on boundary-layer control for isolated air foils has been extended to certain applications on turbocharger blades in a theoretical analysis presented in this report. Boundary-layer control may be used either to delay separation from laminar to turbulent boundary layer or to prevent or delay boundary-layer separation. The former can reduce skin friction and heat transfer, the latter increases allowable blade loading and range of angles of attack.

This analysis suggests that boundary-layer control may have useful applications in conjunction with turbine blade cooling. This is because one of the most effective methods of cooling between blades is by ejecting cooling air at or near the leading edge of the blade. This proved an air jet as an effective method of boundary-layer control which permits increases in blade loading. This procedure reduces the total blade area needed for a given power output. A single stage turbocharger design



IRON CONCENTRATION—Figure A, lead wire in stainless steel. Available in types II or III class A or B. Thermocouple wire coated in a thin oxide film. 15 to 20 to 30 to 50 to 100 to 200 ft.

COPPER-CONCENTRATION—Figure B, lead wire in stainless steel. Available in types II or III class A or B. Thermocouple wire coated in a thin oxide film. 15 to 20 to 30 to 50 to 100 to 200 ft.

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Developed by Lewis, the AN-1011 engine block is used to illustrate the small external resistance of the lead wire to the signal source. Another Lewis design, the AN-1011, is shown with a thermocouple which provides a direct reading of the temperature of the engine block. The thermocouple is used with the AN-1011 indicator.

TERMINALS FOR THERMOCOUPLE LEADS

In preference with AN-1011 is shown as well as electrical and chemical. In addition, the construction of the lead wire and the terminal, with proper insulation, is shown in accordance with the new AN-1011 standard.

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AVIATION WEEK, December 3, 1951

for high pressure ratios may have poor performance at off-design values. Efficiency loss is particularly serious in high-speed, transonic compressors operating below design speeds. The first stages must operate at high angles of attack and may stall, the last stages may be operating in a turbine or may even be subject to negative work. Boundary-layer control may be used to improve this situation also.

Boundary-layer control has not been previously recommended for improving the design performance of the last stages of most flow compressors. This is because high exhaust Mach numbers are required on these stages in order to obtain high mass flow at a high rate of speed.

High Mach numbers require flow blades with relatively low loading in this case the boundary-layer control gives a small.

This report also presents the theory used to determine the blade design with a slot.

► **Construction and Use of Charts in Design Studies of Gas Turbines** (TN 2402)—by Sumner Albert and Rose M. Little.

This report covers the computation and graphical presentation of a series of possible turbine designs for any specific application.

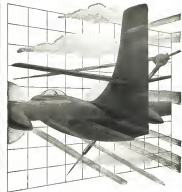
A preliminary design chart is used to get the first estimates of the number of stages required, the type of velocity design and the need for smaller flow area design.

Working with the preliminary design chart supplies the construction of the specific design chart. The axis sets, specific work and efficiency must be known in numerical form the chart can be constructed.

The analysis assumes that one-dimensional flow occurs with no radial components; all losses take place in the axial direction. The use of the rate of specific heat ratio, however, of these limiting assumptions, the results obtained from the methods of the report should be considered as preliminary in nature.

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FLIGHT SHOT of Corsair shown during both on wing and tail sections, and . . .



CLOSE-UP shown both on plane on both sides of refueling on F4U-59L right wing.

Heat on CV De-Ices the Corsair

Navy rush job is typical of emergencies industry meets daily; company did work in 2½ months.

Typical of "emergency" assignments tossed into the lap of the aircraft industry, how they are met and some of the problems encountered was a rush job United Aircraft Corp.'s Chester Vought Aircraft division in Dallas did for the Navy.

What the Navy wanted during both on wings and tail surfaces, de-icing provisions for the propeller (on a type of blade not previously purchased in this manner), a windshield de-icing system, an improved cockpit heater and a complete set of foot covers for the winged pilot.

►Delivered: Tailored—Deicing boots

never had been used on high speed Navy planes, CV jets, and adding to that lack of prior experience was the company's own unfamiliarity with such equipment.

Now request to do the job was received on late September, 1950. F4U-59L deliveries were halted. Two and a half months later deliveries were rolling again, this time without night-fighting. F4U-59Ls—about 400 scheduled. Within three months, the Navy had received nearly 10 of the old weather planes.

In the first time, the company with help from other firms had shipped a com-



This radio plays deadly music

It isn't an important "beam tube" of a guided missile—a tiny radio capsule that is no bigger than a matchbox. It's a vital part of the complex electronics equipment which guides these pitiless weapons to their target with deadly accuracy.

Boeing initiated one of this country's first active guided missile programs authorized after World War II. From

it have evolved newer and more advanced projects in which are assigned a substantial number of Boeing engineers and research scientists. All of these major activities are shrouded in secrecy.

An increasing phase of their development work concerns the "miniaturizing" of electronics equipment. Tiny vacuum tubes, condensers and other

components are assembled in miniature "packages" to save weight and space. They must be tough to stand the shock of supersonic missile flight. They must be highly accurate and dependable.

Boeing's missile projects, like those of other aircraft manufacturers, are a part of an over-all, comprehensive program designed to help build America's defenses.

In the Air Force, Boeing built the B-47 Stratojet, B-48 Superfortress and B-52 Stratofortress, and for the world's leading airlines, Boeing has built Boeings of the new line dual Stratojets.












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plastic water-tight containers, kept up parts production, overcame bottlenecks in procuring certain components, installed the station in the plane, service tested it in flight, maintained accurate "logs" and repaired maintenance records to book form for delivery with each plane.

The Navy then conducted special cold weather tests at Alameda, Navy headquarters, before dispatching the planes to the Pacific front. That the effort paid off after arrival of the New Canton overseas is indicated by subsequent reports of other combat-warfare fighters kept because of wing conditions," says CV.

Full Schedule—Sparking this task job for the company was Henry Tordella, project engineer. CV's reaction to the emergency assignment is illustrated by Tordella's minutes and schedule of business the first week after the Navy asked for water-tight craft. The request came on a Friday—was accepted on Saturday. Tordella started burning red night oil right away.

Schedule in Dallas (1) Faced through equipment and supplies' catalogs, called B. F. Goodrich Co. in Akron, stated problem to them in general terms, determined who to work with at Goodrich, (2) worked out blueprint detailing possible uses for application of boots, etc., and arranged the special delivery to Akron; (3) called Hamilton Standard Propeller division in Hartford, set up appointments.

Headquarters—Flow from Dallas to Akron, made contacts for Monday meetings with Goodrich people.

Monday in Akron, outlined requirements to Goodrich, issued Dodge-McCord equipment also on the way to Akron, after accepting assignment to water-tight AD planes, (2) employed local talent for die-casting boots and Goodrich agreed to supply rubber muds, but wanted a wing weight drawing in obtaining drive mechanism for system, (3) called Eclipse-Tenney division of the Bendix Corp. in Teaneck, N. J., for Wednesday meeting to discuss taken up details and procurement of operating system, (4) flew to Hartford, Conn.

Tuesday in Hartford: Went over propeller anti-icing equipment requirements with Ham Standard engineers. Travelled to Teaneck.

Wednesday in Teaneck (1) Discussed equipment problems with Eclipse-Tenney; (2) found Eclipse could not deliver for four months, while first water-tight plane was needed; (3) made trade in six weeks; (2) With Eclipse engineers, worked up specs on materials that would be required; (4) left Teaneck for Washington, D. C.

Thursday & Friday in Washington: Discussed equipment and difficulties with John E. Sullivan of the Bureau of Aeronautics, who was charged with co-

TEMCO'S New Greenville Plant in Full Swing

A new TEMCO facility now is in full operation. TEMCO-Greenville, the MAJOR'S FIELD plant recently set up in Greenville, Texas, just sixty miles northeast of TEMCO's Dallas headquarters. At present, the new plant is in full swing in its cycle manufacturing project for the AIR FORCE... delivering Military Air Transport C-54's well ahead of schedule from its overhaul production line.

The new plant now houses completely self-contained overhaul facilities for C-54 aircraft including all electrical, instrument, radar and radio, hydraulic, propeller, sheet metal and engine accessory shops. The main double hangar building, housing main components of the overhaul line and all administrative offices, has well over 10,000 square feet of floor space. In addition, there are two 15,000 square foot production hangars and five 16,000 square foot warehouses at the base for TEMCO supplies. Two former hospital buildings at Majors Field have been moved into the TEMCO area and are being fitted up for Personnel and Purchasing and the other as a cafeteria, thus rounding out the completely self-contained operation.

With an employee force of over 700, the new installation has a capacity in excess of 15 completely overhauled aircraft per month.

Major Assembly Work on Schedule at Dallas Plant

In Dallas, at its main plant, TEMCO is continuing to expand its subcontract activities building major assemblies and components for four of the major aircraft contractors... DOUGLAS, MARTIN, BOEING, and LOCKHEED. This work includes some of the nation's fastest and newest planes: the ASD Skyhawk, the F-4 Phantom II, the B-47 Stratojet and the F-100 Super Sabre.

Production engineering ability combined with one of the finest and best equipped facilities in the country has made possible TEMCO's rapid development into "one of the nation's largest aircraft subcontract" firms.

A NEW

TEMCO

Overhaul Facility



Majors Field Greenville, Texas

TEMCO-Dallas now has a separate overhaul division, TEMCO-Greenville at Majors Field, just sixty miles northeast of Dallas. The new facility, recently installed by Texas Engineering and Manufacturing Company, comprises a completely self-contained overhaul production line capable of turning out more than 15 completely overhauled C-54's per month.

"Cycle reconditioning" at the new base is now in full swing on an Air Force contract for the Military Air Transport Service. Recently, the first C-54 to be overhauled in its entirety at TEMCO-Greenville was delivered to the Air Force ten days ahead of schedule.

TEMCO started transferring its C-54 overhaul activities from its main Dallas plant to Greenville early last summer to make way for increased manufacturing operations at Dallas.



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pending the project for Navy. (2) had conference with Capt. Paul Ramsey and J. J. Hensper, now assistant to the general manager at CVT, who had been transferred from Dallas to Washington. (3) after many telephone calls between Baker and Benda, delivery time of Eclipse drawing components was decided by including orders on a pad as equipment would be moved to Dallas as time to meet initial flight tests scheduled for Nov. 4.

Within a week after receiving Navy request, through teamwork of the firm and Naval agencies involved, the basic engineering data had been obtained, status of components known, project strategy settled and an R&D SN also cited for prototype CVT's hold seven passages and 1.4. Cady C. W. Sullivan, of K&R Dallas, had started converting various Naval activities to borrow materials and supplies from manufacturers before arriving in Dallas.

Block Trouble—The project settled down to a fast pace. Materials started flowing into Dallas early in October. The design team spent time in a busy new high-pressure type with little time for experiment on it, so a Coady's representative moved frequently to Dallas to stay on the project. Benda and Hensper Standardization also pitched in.

"A heartbreaker now," says Tremble Low, "when a bolt means a look after we had the specification all made up and in operation." It was necessary to remove the standard bolts with a screw, clean the wing surface and replace them. Normally, it required three days to cure the bolts, but this was cut to two by using heat lamps.

Problems were encountered with the prop deicing system. Tests were conducted by operating the system during ground runs and flights to check the alcohol flow pattern across the blades, spaced periodically with a fine coat of Ben-Avater mastic. The alcohol was poured into a cup at each blade chord and forced centrifugally out along the trough in the lower opening to the blade's leading edge. In spilling out of the trough, the alcohol produced a pattern for evaluation.

Finally, through trial and error, engineers found an acceptable condition.

Cockpit Fumes—The cockpit heater system was used in capacity. The pressure one delivered enough heat to keep the pilot warm, but not enough to dry and dehydrate the inside of the canopy. The new system worked so well it almost drove the pilot out of the cockpit during early tests, says CVT. The more run in, the system required addition of a special heater assembly on the outside of the plane—a case of late detection.

Besides detaching the inside of the windows, deicing equipment was needed to prevent ice formation on the

Jet Compressor Parts



Below: Compressor blades for turbojet aircraft engine. Robbins Engineering specializes in the production of rotor components and complete rotor assemblies.



Above: Complete rotor assembly for turbojet engine, manufactured by the Robbins Engineering Company.



Machined and Assembled to Rigid Specifications

The machining of jet compressor parts and the assembly of complete rotor units require an organization having specialized tooling and inspection equipment and plenty of aircraft know-how. Turbojet engine builders are enthusiastic about the work of the Robbins Engineering Company, a subsidiary of Ex-Cell-O Corporation.

The Robbins organization is cooperating wholeheartedly with the program to build up air power for the defense of our country. All its efforts will be directed toward this end in the present emergency.



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Republic, Boeing, and other leading aircraft manufacturers are using many types of Aerotec Automatic Controls in increasing numbers. These controls are custom designed and built to meet specific problems of high speed and high altitude flight in today's aircraft. Rank Aerotec's outstanding design process right into duplicating actual flight conditions to ensure that the aircraft is dependable.

The photos shown above are typical designs that incorporate Aerotec Automatic Controls. The Republic F-105 Fuel Flow Switch, custom proven results, uses Aerotec pressure switches and a mechanical fuel switch available for tip or piston mounted auxiliary fuel tanks. Boeing has long used Aerotec valves, fuel monitors, and pressure switches on their transport planes.

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outside. So much for spraying oil! The cockpit was mounted on the inside of the windshield. This proved to be a source of double trouble. Pilots soon began slipping handholds skidded down in the cockpit. And in looking up too much alerted, the plastic windshields had become "cracked," so they had to be put away and replaced by Plexiglas of higher crack resistance. A protective coating also was used to increase further their resistance to handslows.

Solving the problem of fumes in the cockpit took a little longer.

Scary Chicago—After a considerable lapse of valuable time, CV engineers discovered the reason and cause of the windshield resistance to seal alcohol staining into the special cockpit heater assembly. To make certain this was the cause of the trouble, the wings were blocked off and sources of peppermint substituted for alcohol for investigative and safety reasons during tests.

But now the odor of peppermint permeated throughout. Eventually, the engineers concluded the aircock was the main trouble, but that the cockpit and access panels near the cockpit also should be sealed better. Fumes finally were eliminated by sealing the cockpit and providing nitrogen sealing.

By keeping full stress on the project and tackling all obstacles with persistence, CV rapidly moved in and out of similar traps and snafus problems, managed to turn out the first H-13D SNL, vintageed Comman 20 days ahead of schedule, 10 weeks after the first emergency call from the Navy.

OUR EXPANDING INDUSTRY

Generalized Machine division, San Diego, based 70,000 sq. ft. of building space at Los Angeles County Fair Grounds to provide veteran engineering, experienced shop and laboratory facilities with the company's future plant capacity. General will lease the fair grounds location by Aug. 3.

Asquith, Inc., Haverhill, Mass., N. J., has been selected to build and test aircraft components, fuselages and general structure in Remond Lighter, formerly steel and service manager for Standard Aircraft Equipment Co. ...

North American Aviation was scheduled to begin building T-6 trainer aircraft at Fresno Air Terminal in May 19 ...

American Pulver Co. Inc., Chicago, has taken an exclusive sales representation in this country for the Swedish-made Koping high-speed lathe, from 16 in. to 40 in. size.



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The Bell HTL-4 and H-13D Helicopters are presently used to bring battle wounded men, and do it fast ... carrying them in their comfortable, warm, safe litters.

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AVIONICS



EXPERIMENTAL aircraft panel for radio station is checked by Ron Sargent.

Down Goes Size of Airborne Radar

Ryan engineers tackle miniaturization problems such as heating, pressurization and vibration resistance.

Submarine surface radar stations are being built expensively to meet the day when no more spare than a "small package" will be altered in or out of design.

These prepping steel poles, under development at Ryan Associates Co., are being anticipated that the next "house" probably will be based on cylinder measuring less than 1 ft in diameter and 2 ft long.

Small for Big Job—Tubes, resistors and coils generally are no larger than a paper clip or key and are tied in a mass of wiring, with some strands as thin as .001 in.

Embodying all the intricacy of the large ship-and-shore installations or the medium-size stations in airborne radar planes, the package adds will have to be extremely compact of limited space.

Most components will be the cold intelligence head, electronic exciter and a power supply section.

The heat treatment energy which, when selected back, is stored by a rugged extreme feeding into electronic circuitry for amplification and "analysis," thus characterized by control functions.

Many Problem—Miniaturization brings with it many problems the designer must solve.

Heat. The closely packed electronic tubes and associated components give off a lot of heat, hence temperature control of the submarine radar is a major problem. Answer to this lies in the air movement of heat-conducting chassis, a difficult job. At high altitudes the situation is reversed and the extreme cold may make it necessary to supply heat through insulating strips.

Pressurization is another consideration. Sealing the package housing often due to an atmosphere of air or inert gas may be the answer.

Resistance to vibration and shock is



SCREENING—parts stick up forwardly with paper clips and cigarette pack. Upper panel shows double vacuum tube, lower is for tube order amplifier.



PLASTIC block holds printed components.



WIRING of submarine control requires good "trick" and tools.



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another major design problem, offering for careful selection of mounts and dampers.

■ **Design Approach**—Direct design for where installation is not always the strict procedure. First, the designer may use standard-size parts to establish component values and the feasibility of the actual paper arrangement of the parts.

After this the subassembly layout is set up on an experimental stand, with wide spacing between components for ease, yet to be adjustment and change. Then the various units are arranged on a circuit panel to check overall base-tension before the required degree of compactness is obtained.



Avionic Checker

A new instrument for checking avionic equipment is being offered by the Bristol Engineering Corp., Lincoln, U.S. and Ford St., Bristol, Pa. Unit is designated Model 650 Multi-Power Supply.

The manufacturer says that the equipment contains in a single unit virtually all of the low-voltage required in a normal laboratory experimental setting. It features two regulated d.c. supplies, completely independent and isolated from ground and each other. They may be used singly or in any combination with either the positive or the negative terminal of the supplies grounded.

In addition, a filament supply, a negative 150v. bias supply and a nominal 17v. d.c. supply are included in the unit.

Design features include separate power switches for each channel, complete fusing for all voltages, voltmeter and ammeter switching to measure all regulated voltages and a hand-controlled outlet for operating external equipment.

The unit is available either in a cabinet 10 1/2 in. high by 22 in. wide by 17 1/2 in. deep or a chassis cabinet for rail installation. Cabinet unit costs \$595, the rack-mounting unit is \$551. Delivery time quoted is from four to six weeks.

AVIATION WEEK, December 2, 1951

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EQUIPMENT



FIG. 1 CAL Y (right) tests a rising CAL test lead over chafed engine leads.

Continental Sets Sights on Future

Small fleet operator, soon to add seven Convair 340s, finds it cashes in on maintenance employee ingenuity.

By George L. Christian

Dennis—Proper maintenance of even a small fleet requires alert and on-the-job thinking.

That fact independent thinking pays off was well demonstrated to the writer on a visit last year to Continental Air Lines main overhaul base at Appleton Field here. At that time, CAL was able to house the latest state-of-the-art U. S. airlines for unscheduled removals in 1949 of R-2800 engines (used in its Convair 240s). It was used only to R-2800, on a world-wide basis (Aviation Week Dec. 4, 1956, p. 37).

Now, a return visit finds CAL with its sights on the future, already planning new and modern equipment for its fleet of seven Convair 340s, the first of which is to be delivered next September. All of Continental's scheduled flights are currently operated with Convair 340s and DC-3s. In addition, the carrier has based one DC-4 from Los Angeles Air Service for charter work.

► New Lead—Ingenuity of CAL maintenance personnel has solved many of the carrier's problems, according to R. C. Johnson, superintendent of maintenance.

The low tension ignition leads on Continental's R-2800 engines leads, which run from the spark plug to the high tension coil adjuster to the spark plug, chafed at the meshfold end. Resultant short circuiting required that

the leads be secured—a job requiring a lot of time. And new leads cost approximately \$40, Johnson said.

So Earl Peters went to work on the problem and came up with a simple and inexpensive solution. He manufactured a new type "Y" fitting for the meshfold end of the leads. The new Y incorporates a hollow space in which a 14-in. bit of terylene wiring can be strung. Terylene is so good at wiring it can be pulled out for patching to new lead socket. Extra wire is then coiled back into the spare space.

Peters' Y was fine. It is quicker to manufacture the new Y and fewer new leads than to secure the old configuration. Cost is negligible compared to replacing the new leads at \$40.

Continental's estimate of cost of the new assembly are: materials for the Y \$2.00, additional work, \$2.00, and \$4.00.

Make-up and reworking of the Peters assembly (both leads) can be done in 15-20 min., according to Peters.

► Hot Lead—CAL was also experiencing troubles with the short high tension leads running from coil to spark plug on the rear cylinders of the R-2800s. The leads cooked badly, especially when the engine was shut down. Results were that leads cracked just above the "spigots," and split between female and male socket end.

Again, Peters came to the rescue. Long termers were substituted for the



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SKYDROL in United Air Lines' new Convair-Liner 340's

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SKYDROL is nontoxic—does not require special handling or protective clothing.

Sketch by S. J. Fox



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SKYDROL in Braniff International Airways' new Convair-Liner 340's

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back to new 150-ppt. ADI find mixing tool. Novel arrangement in a pump which mixes the fluid (99% alcohol, 90% distilled water) and immediately filters out impurities.

• **Spill plug cleaning.** CAL has its own way of cleaning clogging DG plugs. An emulsified solution of ammoniac acetate is used to dissolve any solid compounds-in operation that takes 15-30 min.

Then, ounces come in a tumbled in a bridge-packer member of 4-pow. 8-thing acids, purifier. Don't soap, phosphate and water for two hours. Can manual maintenance personnel clean that this cleaning method is more effective and convenient than doing it by hand.

• **Maintenance training track.** CAL has found an inexpensive yet effective way to keep its station equipment sharp and shiny.

A 2-ton food truck makes a tour of every station once a year. During the 15-month trip, the driver maintains close personnel at all light maintenance required at each station. Can find an streamlined, loading stands are in pairs, all equipped with a pump jet gets a free coat—that station can give a general house cleaning from the eyes.

• **Cabin baggage overhaul.** The cabin is undergoing overhaul to Mal Can (noted Airlines) overhaul here at Miami spoke to study MCA's overhaul setup for General cargo airplanes which CAL plans to adopt. This is another step toward a making toward self-sufficiency.

When Combs took delivery of the new Carrier 748 (first plane is scheduled for delivery in September, 1972, the last in April, 1973) it will have as quickly and efficient a fleet of aircraft in any sector of comparable size and resources in the country. Steadily rising payloads seem to accelerate the wisdom of this expansion.

UAL To Install E-P Control Systems

Eclipse Power division of Bendix Aviation Corp. announces that 85 Flight Path Control systems have been purchased by United Air Lines. Of these, 44 will be installed on DC-64, 20 on DC-8s, the rest are on 747s.

Flight Path Control, an Eclipse Power development, ties the ILS localizer and glide path beams into an aircraft's automatic pilot, allowing the latter to control the plane to fly precisely along the two beams. This is known as the option of actually plotting the plane when letting down under instrument conditions. The pilot, however, does take over manually and hand the plane when he is contact.

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